

Structural-Acoustic Simulations in Early Airframe Design, Phase I

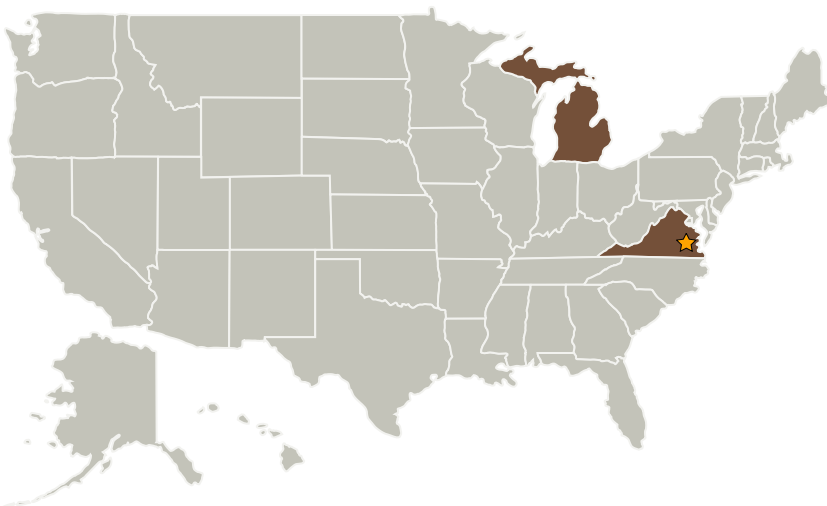
Completed Technology Project (2007 - 2007)



Project Introduction

The structural design during the early development of an aircraft focuses on strength, fatigue, corrosion, maintenance, inspection, and manufacturing. Usually the acoustic requirements are met after the design of the fuselage structure has been completed. Ideally the structural-acoustic concerns should enter the design cycle early and they should be considered along with other main design disciplines within a Multi-disciplinary Design Optimization (MDO) environment. The proposing firm is uniquely positioned for developing technology which will bring structural-acoustic simulations early in the airframe design process because of their Energy Finite Element Analysis (EFEA) product for structural-acoustic simulations of large systems, and their development of a general purpose code for Multi-disciplinary Design Optimization under Uncertainty (MDO-U). The proposed Phase I project will demonstrate the feasibility of including structural-acoustic simulations in early airframe design. An adjoint sensitivity formulation will be implemented in the EFEA for enabling the utilization of the EFEA within a design optimization environment. In a case study a representative airframe structure will be optimized simultaneously for two different disciplines, using common design variables. An impact type of concern (representative of impact applications for rotorcraft and aircraft, and of shock applications for launch vehicle dynamics) and a structural-acoustic performance due to structure-borne and air-borne excitations (representative to aircraft, rotorcraft, and launch vehicle applications) will be considered. The MDO-U and the EFEA codes will be utilized in the case study, which will demonstrate the feasibility and the value of bringing structural-acoustics early in the design cycle.

Primary U.S. Work Locations and Key Partners



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Organizational
Responsibility**Responsible Mission
Directorate:**

Space Technology Mission
Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation
Research/Small Business Tech
Transfer

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Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Michigan Engineering Services, LLC	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Ann Arbor, Michigan

Primary U.S. Work Locations

Michigan	Virginia
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.3 Aeroelasticity